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OFFICE OF CHEMICAL SAFETY
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MEMORANDUM

SUBJECT: **MGK-264:** Drinking Water Assessment for Registration Review

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1. Executive Summary

The Environmental Fate and Effects Division (EFED) has completed the Drinking Water Assessment (DWA) for the Registration Review of the insecticide synergist MGK-264 (CAS Reg. No. 113-48-4), also known as N-octyl bicycloheptene dicarboximide and 2-ethylhexyl bicycloheptene dicarboximide. Since the last DWA for MGK-264 was conducted in 2005,[1] all outdoor uses of MGK-264 other than uses on building surfaces have been canceled. Therefore, this DWA includes only estimated drinking water concentrations (EDWCs) resulting from indoor uses and an updated summary of available monitoring data.

[1] Drinking Water Assessment for MGK-264 Insecticide Synergist: Surface Water Revision for Ground Spray. Eckel, W.; D305104; February 17, 2005.

Maximum EDWCs for MGK-264 in surface water are presented below in **Table 1**. MGK-264 contamination of ground water is not modeled and is expected to be negligible.

Table 1. Maximum Estimated Drinking Water Concentrations for MGK-264

Drinking Water Source	Model Used	Use	Maximum Estimated Drinking Water Concentration (EDWC) (ppb)		
			Peak	Chronic	Cancer
Surface water	E-FAST Down-the-drain	Indoor uses	3.31	1.84	0.42

2. Use Characterization

In 2011, the MGK-264 technical label was amended to limit outdoor uses of MGK-264 to treatments of building surfaces only. The technical label (EPA Reg. No. 1021-88) allows outdoor use for only "residential outdoor restricted to building surfaces and spot treatments on structures." Since 2011, all end-use product labels have been updated to reflect this change. A wide variety of indoor uses are also labeled for MGK-264. Some of these uses may result in discharge through sewage systems, such as carpet treatments, pet products, and treated articles of clothing. Other indoor uses include food storage, distribution, and preparation facilities and general household uses. There are 245 active registrations for MGK-264 listed in the Agency's OPPIN database. For a detailed use table for MGK-264, see **Appendix A**.

3. Environmental Fate and Transport Characterization

The environmental fate and transport of MGK-264 was described in detail in EFED's 2012 Registration Review Problem Formulation for MGK-264.[2] A brief summary of that discussion is included here. The table of physicochemical and environmental fate parameters for MGK-264 compiled for the Problem Formulation is in **Appendix B**.

MGK-264 consists of a diastereomeric pair of two enantiomers. The diasteriomers are *endo* – *exo* isomers in the ring structure and are a result of the 3-dimensional structure of the molecule. MGK-264 is moderately mobile (K_{oc} = 839 L·kgoc^{-1}) and persistent in the environment with a mean aerobic soil metabolism half of 346 days, which appears to be the dominant route of degradation. Anaerobic soil metabolism is in the same range as aerobic soil metabolism with a half-life of 211 days. The vapor pressure (1.84 x 10^{-5} torr) indicates that MGK-264 is semi-volatile. However, the estimated Henry's Law constant is 4.44 x 10^{-7} atm·m^3·mol^{-1} suggest that is has little propensity to volatilize from water. MGK-264 is stable to hydrolysis and direct aqueous photolysis, and degrades slowly ($T_{1/2}$ = 177 d) by soil photolysis. MGK-264 aerosols in air are expected to be rapidly degraded (half-life ~ 1.4 hr) by reaction with ozone and hydroxyl radical based on structure-activity relationships.

4. EDWC Modeling: Down-the-Drain

Because outdoor uses of MGK-264 are limited to building surfaces, runoff or spray drift of MGK-264 to drinking water sources, while possible, is expected to be negligible.

[2] U.S. EPA. 2012. EFED Registration Review Problem Formulation for MGK-264. Judkins, D. and Jones, R.D.; D398160; May 22, 2012.

For indoor uses that may result in MGK-264 entering sewage systems, the Exposure and Fate Assessment Screening Tool (E-FAST) v.2.0 down-the-drain model is used to calculate EDWCs.[3] This is a screening-level model that assumes that in a given year the entire production volume of a chemical is parceled out on a daily basis to the entire U.S. population and converted to a mass release per capita and daily per capita release to a wastewater treatment facility (*i.e.*, g/person/day). This mass is then diluted into the average daily volume of wastewater released per person to arrive at an estimated concentration of the chemical in wastewater prior to entering a treatment facility.

EDWCs from down-the-drain exposure are derived from proprietary production estimates submitted by the technical registrant, MGK Company, in 2011 (MRID 48383501). These are the most recent production data available to the Agency. The EDWCs are based on the conservative assumption that all MGK-264 products, including products for outdoor use, went down the drain.

Model output includes water concentrations for four types of stream flows (SF):

1. SF_{1Q10} is the stream flow that corresponds to the single day of lowest flow over a 10-year period (*i.e.*, lowest 1-day flow during any 10-year period).
2. SF_{7Q10} is the stream flow corresponding to seven consecutive days of lowest flow over a 10-year period (*i.e.*, lowest consecutive 7-day average flow during any 10-year period).
3. SF_{30Q5} is the stream flow corresponding to thirty consecutive days of lowest flow over a 5-year period (*i.e.*, lowest consecutive 30-day flow during any 5-year period).
4. Harmonic Mean Flow ($SF_{harmonic}$) is the inverse mean of the reciprocal daily arithmetic mean flow values.

Table 2 presents the model results.

Table 2. E-FAST Down-the-Drain Model Output

Drinking Water Exposure Duration	Peak	Peak	Chronic	Cancer
Stream Flow	1Q10	7Q10	30Q5	Harmonic mean
Water Concentration (ppb)	3.31	3.31	1.84	0.42

5. Monitoring Data

The Water Quality Portal (WQP)[4] was searched for current monitoring information on MGK-264. The WQP includes water monitoring data from USGS National Water Information System (NWIS) and the EPA STOrage and RETrieval (STORET) Data Warehouse. The STORET database[5] identified MGK-264 by the CAS No. 113-48-4 as n-2-ethylhexylbicycloheptenedicarboximide and this chemical name was used to search the WQP. In 3,424 sample results from 486 sites no detections of MGK-264 were reported.

[3] https://www.epa.gov/tsca-screening-tools/e-fast-exposure-and-fate-assessment-screening-tool-version-2014
[4] http://www.waterqualitydata.us/
[5] https://www.epa.gov/waterdata/storage-and-retrieval-and-water-quality-exchange

Appendix A. Registered Uses of MGK-264

The following use information and Use Table were compiled by the Health Effects Division.

MGK-264 is mostly used in indoor residential (*e.g.*, homes, apartments, hotels, restaurants) and commercial settings (*e.g.*, warehouses, food processing facilities, kennels, barns, poultry houses, transit/shipping vehicles/containers, etc.) and directly on pets and livestock. It is also an ingredient in some personal insect repellent products. There are no agricultural crop uses nor are there other broadcast outdoor treatments such as wide area mosquito abatement programs or treatments to rights-of-ways. Outdoor uses are limited to spot/directed treatments of structural areas/components where insects might hide or nest such as home or building surfaces (*e.g.*, soffits, eaves, doors, patios, porches).

Most products are liquids, either concentrates, ready-to-use solutions, or pressurized; other formulations include dusts, impregnated wipes, and a handheld roller. Types of applications vary from broadcast to more directed treatments (*e.g.*, spot and crack-and-crevice) via various types of equipment (*e.g.*, handheld foggers, aerosol cans, pressurized hand sprayers, dips/sponges/shampoos, etc.). Metered-release aerosol sprayers are used in indoor commercial settings and misting systems are used in indoor agricultural settings such as barns or other animal housing areas.

Table A.1. Summary of Registered Use Directions for MGK-264

Application Type/Equip/etc.	Formulation [Representative EPA Reg. No.]	Application Rate	PPE/Work Attire, Retreatment
Direct Application to Animals			
• Dip • Sponge	Liquid concentrate EPA Reg. No. 1021-1552 (Evercide Pet Dip) 14.36% MGK-264	0.02 lb ai/gallon solution 1 quart solution/animal 0.004 lb ai/animal	• Long-sleeve shirt, pants, shoes/socks • Chemical-resistant gloves • Chemical-resistant apron • Respirator
• Trigger spray bottle • Manually pressurized handwand	Liquid concentrate EPA Reg. No. 1021-2739 (Py Butacide 163) 10% MGK-264	0.024 lb ai/gallon solution	• Long-sleeve shirt, pants, shoes/socks • Respirator
• Handheld fogger	Liquid concentrate EPA Reg. No. 89459-27 (Prentox Pyronyl Oil Concentrate) 10% MGK-264	0.03 lb ai/gallon solution 2 fl oz solution/animal 0.0004 lb ai/animal	• Long-sleeve shirt, pants, shoes/socks • Respirator
• Shampoo	Liquid concentrate EPA Reg. No. 1021-1723 (Pyrocide Flea and Tick Shampoo) 0.48% MGK-264	0.005 lb ai/gallon shampoo (assumes a 16 fluid ounce bottle)	• No PPE • 7 day retreatment

Table A.1. Summary of Registered Use Directions for MGK-264			
Application Type/Equip/etc.	**Formulation [Representative EPA Reg. No.]**	**Application Rate**	**PPE/Work Attire, Retreatment**
• Wipe/Towelettes	Impregnated material EPA Reg. No. 2724-617 (Speer Repellent Towelette II) 0.39% MGK-264	0.00004 lb ai/wipe (assumes a 0.15 oz wipe) 0.0001 lb ai/animal (assumes 3 wipes per animal)	• No PPE • 1 application per day for horses and livestock • 1 application per week for pets
• Roller (deodorant-style)	Gel/paste EPA Reg. No. 47000-185 (War Paint) 21% MGK-264	12 grams/horses 0.054 lb ai/horse	• No PPE • Horses only • 7 day retreatment
Indoor Residential Settings			
• Shaker can	Dust EPA Reg. No. 2596-161 (Hartz Reference 150) 1.18% MGK-264	0.0118 lb ai/can (assumes 16 oz can) 3'x3' spot treatment	• No PPE • 30 day retreatment
• Trigger spray bottle • Manually pressurized handwand • Fogging equipment • Metered-release aerosol	Liquid concentrate EPA Reg. No. 1021-2739 (Py Butacide 163) 10% MGK-264	0.024 lb ai/gallon solution 0.05 lb ai/1000 square feet 0.006 lb ai/1000 cubic feet	• Long-sleeve shirt, pants, shoes/socks • Respirator • Retreatment not specified
• Total release fogger	Pressurized liquid EPA Reg. No. 1021-1558 (Evercide Total Release Fogger) 0.38% MGK-264	2 ounce can per 2000 cubic feet	• Long-sleeve shirt, pants, shoes/socks • Chemical-resistant gloves • No PPE on consumer use label • Wait 2 hours after application, then open windows, vents, and doors for 2 hours. If an odor is still detectable, additional ventilation is required. • Retreatment not specified
• Aerosol can	Pressurized liquid EPA Reg. No. 2724-490 (RF 9910 Aerosol) 2% MGK-264	0.001 lb ai per 16 oz can 16 oz can/2000 square feet 0.001 lb ai/2000 square feet	• Long-sleeve shirt, pants, shoes/socks • Chemical-resistant gloves • No PPE on consumer use label • 14 day retreatment
Indoor Commercial Settings			
• Trigger spray bottle • Fogging equipment • Metered-release aerosol	Liquid concentrate EPA Reg. No. 1021-2739 (Py Butacide 163) 10% MGK-264	0.024 lb ai/gallon solution 0.05 lb ai/1000 square feet 0.006 lb ai/1000 cubic feet	• Long-sleeve shirt, pants, shoes/socks • Respirator • Retreatment not specified

Table A.1. Summary of Registered Use Directions for MGK-264			
Application Type/Equip/etc.	**Formulation [Representative EPA Reg. No.]**	**Application Rate**	**PPE/Work Attire, Retreatment**
• Manually pressurized handwand • Mechanically pressurized handgun	Liquid concentrate EPA Reg. No. 46579-8 (Pyra-Fog 3-6-10) 10% MGK-264	0.17 lb ai/1000 square feet	• Long-sleeve shirt, pants, shoes/socks • Chemical-resistant gloves • Respirator • Retreatment not specified
• Aerosol can	Pressurized liquid EPA Reg. No. 2724-490 (RF 9910 Aerosol) 2% MGK-264	0.001 lb ai per 16 oz can 16 oz can/2000 square feet 0.001 lb ai/2000 square feet	• Long-sleeve shirt, pants, shoes/socks • Chemical-resistant gloves • No PPE on consumer use label • 14 day retreatment
Indoor Agricultural Settings			
• Manually pressurized handwand • Fogging equipment • Mechanically pressurized handgun • Metered-release aerosol	Liquid concentrate EPA Reg. No. 1021-2739 (Py Butacide 163) 10% MGK-264	0.024 lb ai/gallon solution 0.05 lb ai/1000 square feet 0.006 lb ai/1000 cubic feet	• Long-sleeve shirt, pants, shoes/socks • Respirator • Retreatment not specified
• Aerosol can	Pressurized liquid EPA Reg. No. 2724-490 (RF 9910 Aerosol) 2% MGK-264	0.001 lb ai per 16 oz can 16 oz can/2000 square feet 0.001 lb ai/2000 square feet	• Long-sleeve shirt, pants, shoes/socks • Chemical-resistant gloves • No PPE on consumer use label • 14 day retreatment
• Misting system	Liquid concentrate EPA Reg. No. 46579-8 (Pyra-Fog 3-6-10) 10% MGK-264	0.03 lb ai/gallon solution 5.5 fl oz solution/1000 cubic feet per day 0.001 lb ai/1000 cubic feet per day	• Long-sleeve shirt, pants, shoes/socks • Chemical-resistant gloves • Respirator • Retreatment not specified
Personal Insect Repellent			
• Aerosol can • Trigger spray bottle	Pressurized liquid EPA Reg. No. 51147-13 (Morpel Insect Repellent Spray 2559) 5% MGK-264	0.02 lb ai/can (assumes 6.5 oz can)	• Repels mosquitoes up to 8 hours • No more than 3 applications per day for children under 12 years old
Outdoor Structural/Building Surfaces (Spot/Directed) (e.g., soffits, eaves, doors, patios, porches)			
• Aerosol can	Pressurized liquid EPA Reg. No. 1021-1852 (Evercide Wasp and Hornet Spray) 0.08% MGK-264	0.00005 lb ai/can (assumes 16 oz can)	• No PPE • No retreatment specified
• Trigger spray bottle • Manually pressurized handwand	Liquid concentrate EPA Reg. No. 89459-35	0.04 lb ai/1000 square feet	• Long-sleeve shirt, pants, shoes/socks • Respirator

Table A.1. Summary of Registered Use Directions for MGK-264			
Application Type/Equip/etc.	**Formulation [Representative EPA Reg. No.]**	**Application Rate**	**PPE/Work Attire, Retreatment**
• Fogging equipment	(Prentox Insect Spray and Fogging Concentrate) 1% MGK-264		• Retreatment not specified

Appendix B. Physicochemical and Environmental Fate Properties of MGK-264

Table B-1. Physicochemical and Environmental Fate Properties of MGK-264

Parameter	Value	Reference
Selected Physical/Chemical Parameters		
Chemical Formula	$C_{17}H_{25}NO_2$	--
Molecular Weight	275.38 g·mol	calculated
Water Solubility	15 $mg \cdot L^{-1}$ at 25° C	MRID 40528901
Vapor pressure	1.84 x 10^{-5} torr @ 25°C	MRID 40528901
Density	1.049 g/mL @ 20°C	MRID 40528901
Henry's Law Constant	4.44 x 10^{-7} $atm \cdot m^3 \cdot mol^{-1}$	calculated from solubility and vapor pressure
Octanol/Water Partition Coefficient (K_{ow})	isomer 1: 4074 at 24°C isomer 2: 6309 at 24°C	MRID 40528901
Hydrolysis $t_{1/2}$	no evidence of degradation @ all pHs	MRID 42222601
Aqueous Photolysis $t_{½}$	no evidence of degradation	MRID 42222602
Soil Photolysis	177 d	MRID 42807501
Aerobic Soil metabolism $t_{½}$	294 d in San Joaquin silt loam 388d in San Joaquin silt loam	MRID 43194501
Anaerobic Soil metabolism $t_{½}$	211 days	MRID 43194502
Mobility		
Batch Equilibrium	K_f =1.6 - Tiffany sand 2.7 - San Joaquin sandy loam 5.4 - Anthony sandy loam 20 - Dundee clay loam 33 – Gardenia clay loam 1/n values ranged from 0.8-1.1 K_{oc} = 839 $L \cdot kg_{oc}^{-1}$	MRID 42622501